CLAIMS

What is being claimed is:

1. A semiconductor light emitting device comprising:

a nucleation region; and

an epitaxial structure comprising:

a base region formed on the nucleation region; and

a III-nitride light emitting layer overlying the base region and disposed between an n-type region and a p-type region and overlying the base region; wherein:

the light emitting layer is configured to emit light having a peak emission wavelength greater than 420 nm; and

the light emitting layer and base region are configured such that:

the light emitting layer has an average InN composition b; and

an InN composition at any point in the light emitting layer is between (b-0.2b) and (b+0.2b).

- 2. The device of claim 1 wherein the InN composition at any point in the light emitting layer is between (b 0.1b) and (b + 0.1b).
- 3. The device of claim 1 wherein InN composition at any point in the light emitting layer is between (b 0.05b) and (b + 0.05b).
 - 4. The device of claim 1 wherein the light emitting layer is InGaN.
 - 5. The device of claim 1 wherein:

the base region has a lattice constant a₁;

a relaxed, free standing layer having a same composition as the light emitting layer has a lattice constant a₂; and

a ratio of a_2 to a_1 is between about 1 and about 1.01.

- 6. The device of claim 1 wherein the base region is $Al_xIn_yGa_zN$, where $0 \le x \le 1$, $0 \le y \le 1$, and $0 \le z \le 1$.
- 7. The device of claim 1 wherein the base region is In_xGa_yN , where $0 \le x \le 1$ and $0 \le y \le 1$.
- 8. The device of claim 1 wherein a dislocation density in the n-type region, light emitting layer, and p-type region is less than about $5x10^8$ cm⁻².
- 9. The device of claim 1 wherein the light emitting layer and any layers between the light emitting layer and the base region are strained.
 - 10. A semiconductor light emitting device comprising:

a nucleation region; and an epitaxial structure comprising:

- a base region formed on the nucleation region; and
- a III-nitride light emitting layer overlying the base region and disposed between an n-type region and a p-type region; wherein the light emitting layer and base region are configured such that:

the light emitting layer has an average InN composition b; the average InN composition b is greater than 8%; and an InN composition at any point in the light emitting layer is between (b - 0.2b) and (b + 0.2b).

- 11. The device of claim 10 wherein the InN composition at any point in the light emitting layer is between (b 0.1b) and (b + 0.1b).
- 12. The device of claim 10 wherein InN composition at any point in the light emitting layer is between (b 0.05b) and (b + 0.05b).
 - 13. The device of claim 10 wherein the light emitting layer is AlInGaN.
 - 14. The device of claim 10 wherein:

the base region has a lattice constant a₁;

a relaxed, free standing layer having a same composition as the light emitting layer has a lattice constant a2; and

a ratio of a_2 to a_1 is between about 1 and about 1.01.

- 15. The device of claim 10 wherein the base region is $Al_xIn_yGa_zN$, where $0 \le x \le 1$, $0 \le y \le 1$, and $0 \le z \le 1$.
- 16. The device of claim 10 wherein the light emitting layer is configured to emit light having a peak emission wavelength greater than 420 nm.
 - 17. A III-nitride light emitting device comprising:
 - a nucleation region;

a base region formed on the nucleation region, the base region having a lattice constant a_1 ; and

a light emitting layer overlying the base region and disposed between an n-type region and a p-type region; wherein:

the light emitting layer has an average InN composition greater than 8%; a relaxed, free standing layer having a same composition as the light emitting layer has a lattice constant a₂; and

- a ratio of a₂ to a₁ is between about 1 and about 1.01.
- 18. The device of claim 17 wherein the light emitting layer is configured to emit light having a peak emission wavelength greater than 420 nm.
- 19. The device of claim 17 wherein the base region is $Al_xIn_yGa_zN$, where $0 \le x \le 1$, $0 \le y \le 1$, and $0 \le z \le 1$.
- 20. The device of claim 17 wherein the base region is In_xGa_yN , where $0 \le x \le 1$ and $0 \le y \le 1$.
- 21. The device of claim 17 wherein a dislocation density in the base region, n-type region, light emitting layer, and p-type region is less than about 5x10⁸ cm⁻².
 - 22. The device of claim 17 wherein:

the light emitting layer is In_xGa_yN where $0.08 \le x \le 1;$ and

the base region is In_aGa_bN where $(x-0.08) \le a \le 1$.

- 23. The device of claim 17 further comprising:
- a first contact electrically connected to the n-type region;
- a second contact electrically connected to the p-type region;
- a lead frame electrically connected to the first and second contacts; and
- a cover overlying the light emitting layer.
- 24. The device of claim 17 wherein the light emitting layer has a thickness greater than 5 nm.
- 25. The device of claim 17 wherein the light emitting layer has a thickness greater than 10 nm.
- 26. The device of claim 17 wherein the light emitting layer is a first quantum well, the device further comprising:
 - a second quantum well; and
 - a barrier layer disposed between the first and second quantum well.
- 27. The device of claim 17 wherein the light emitting layer and any layers between the light emitting layer and the base region are strained.
 - 28. The device of claim 17 wherein the base region is the n-type region.
 - 29. A III-nitride light emitting device comprising:
 - a substrate;
 - a base region formed on the substrate, the base region having a lattice constant a₁; and
- a light emitting layer overlying the base region and disposed between an n-type region and a p-type region; wherein:

the light emitting layer has an average InN composition greater than 8%; a relaxed, free standing layer having a same composition as the light emitting layer has a lattice constant a₂; and

a ratio of a₂ to a₁ is between about 1 and about 1.01.

- 30. The device of claim 29 wherein the light emitting layer is configured to emit light having a peak emission wavelength greater than 420 nm.
- 31. The device of claim 29 wherein the base region is $Al_xIn_yGa_zN$, where $0 \le x \le 1$, $0 \le y \le 1$, and $0 \le z \le 1$.
- 32. The device of claim 29 wherein the base region is In_xGa_yN , where $0 \le x \le 1$ and $0 \le y \le 1$.
 - 33. The device of claim 29 wherein:

the light emitting layer is In_xGa_yN where $0.08 \le x \le 1$; and the base region is In_aGa_bN where $(x-0.08) \le a \le 1$.

- 34. The device of claim 29 wherein the substrate is SiC.
- 35. A method comprising:

growing an epitaxial stack on a growth substrate, the epitaxial stack comprising:

a base region having a lattice constant a1; and

a light emitting layer overlying the base region and disposed between an ntype region and a p-type region;

bonding the epitaxial stack to a host substrate; and removing the growth substrate; wherein:

the light emitting layer has an average InN composition greater than 8%; a relaxed, free standing layer having a same composition as the light emitting layer has a lattice constant a₂; and

a ratio of a_2 to a_1 is between about 1 and about 1.01.

- 36. The method of claim 35 wherein the light emitting layer is configured to emit light having a peak emission wavelength greater than 420 nm.
- 37. The method of claim 35 wherein the base region is $Al_xIn_yGa_zN$, where $0 \le x \le 1$, $0 \le y \le 1$, and $0 \le z \le 1$.
- 38. The method of claim 35 wherein the base region is In_xGa_yN , where $0 \le x \le 1$ and $0 \le y \le 1$.
 - 39. The method of claim 35 wherein: the light emitting layer is In_xGa_vN where $0.08 \le x \le 1$; and

the base region is In_aGa_bN where $(x-0.08) \le a \le 1$.